Remarks

Applicant has amended claim 8 to overcome the informality leading to its objection.

The Office Action rejected claims 1, 2, 4, 7, 8, and 10, asserting that the claims are unpatentable under 35 U.S.C 103(a) in light of U.S. Patent 4,816,078 to Schiweck in combination with all of the following viewed collectively: U.S. Patent 4,831,127 to Weibel (Weibel-1), U.S.5,008,254 to Weibel (Weibel-2), Shibanuma et al. *J. App;. Glycosci.*, Vol. 46, pages 249-256 (Shibanuma), and Gatzi et al. *Helv. Chim. Acta.* (1938), 21, 195-205 (Gatzi).

a. **Shibanuma**

Applicant points out that Shibanuma was published later than the international filing date of the present application (April 26, 1999), not to mention applicants' May 1, 1998 Japanese priority date. On the last page of Shibanuma, it is described that Shibanuma was accepted on May 26, 1999. Therefore, Shibanuma could not have been published before April 26, 1999, and cannot be considered prior art. Because the rejection relies on the teachings of Shibanuma to the purported obviousness, removal of that reference should cause the withdrawal of the rejection.

b. **Schiweck**

The present invention relates to a process for manufacturing L-arabinose from vegetable

fibers by acid hydrolysis. The commonly used previous extraction of hemicellulose such as arabinan and arabinoxylan with an alkali such as $Ca(OH)_2$ is eliminated, as demonstrated in the specification at pages 5 and 6.

Schiweck, however, discloses a process comprising commonly used previous extractions of hemicellulose with an alkali. In claim 1 of Schiweck, step (a) is defined wherein the araban containing plant material is dissolved by adding $Ca(OH)_2$. (See Examples 1-3 of Schiweck)

When vegetable fiber is treated with an alkali as in Schiweck, hemicellulose is extracted. The hemicellulose consists of various monosaccharides including L-arabinose. Thus, when the hemicellulse is treated with acid, many different monosaccharides including L-arabinose are liberated which leads to low purity of arabinose.

In contrast, in the process according to the present invention, vegetable fiber is directly treated with acid so as to selectively liberate L-arabinose, which is present at the non-reducing terminals of the vegetable fiber leading to increased purity of L-arabinose. (See the paragraph bridging from page 5 to page 6 of the present specification)

For example, in Example 1 of the present specification, 93% purity of L-arabinose (occupying rate of L-arabinose) is achieved. (See the tope row of Table 1, page 17 of the present specification) Such high purity of L-arabinose is very advantageous especially when manufacturing L-arabinose commercially. Unfortunately, in examples 1, 2, and 3 of Schiweck, it is not clear how much the purity of L-arabinose was after acid hydrolysis with H_2SO_4. However, in the "Background Art" section of the present specification, it is described that according to the method disclosed in Japanese Patent Laid-Open No. 312997/1997, purity of L-arabinose (the L-arabinose content in the monosaccharide) is calculated as low as 18.9%. Therefore, such a method is not practical. (See the paragraph bridging from page 3 to 4 of the present specification)

While the final purity of L-arabinose in Schiweck is 95% in Example 1, the yield is modest, making Schiweck's process unsuitable for commercial manufacture. In contrast, the present invention selectively targets L-arabinose during acid hydrolysis resulting in greater yield.

c. **Weibel-1**

The present invention relates to a process for producing relatively pure L-arabinose using acid hydrolysis of vegetable fibers. Acid hydrolysis is a reaction by which polysaccharides such as hemicellulose are degraded to become monosaccharides such as L-arabinose.

Weibel-1 discloses a method of manufacturing hemicellulose, a polysaccharide, using acid hydrolysis. The starting material and the type of treatment may be similar to those of the present invention, but the product by the disclosed process is hemicellulose. Degradation of hemicellulose will produce small amounts of L-arabinose as well as other monosaccharides as seen in Example 6, but Weibel-1 specifically seeks to avoid such degradation. Where such degradation occurred, in Example 6, a process of enzymatic digestion rather than acid hydrolysis was used. Therefore, Weibel-1 does not teach the production of pure L-arabinose on a large scale, but in effect teaches away from the hydrolysis of the hemicellulose that the present invention seeks to perform.

Weibel- 1, in claim 25, also adds the condition of mechanical shearing, which is performed after acidic hydrolysis of plant material, and is selected "substantially to disassociate said hemicellulose from said cellulose without causing substantial degradation of said hemicellulose." Weibel-1 discourages the process of degradation of hemicellulose to monosaccharide form.

d. **Weibel-2**

The disclosure of Weibel-2 is nearly identical to Weibel-1. Weibel-2 merely discloses a process for producing pectin. Pectin is a polysaccharide that is made up of several monosaccharides such as L-arabinose, D-galactose, and others bonded together in a condensation reaction. However, the mere fact that pectin may contain quantities of L-arabinose does little to show others in the art a method of producing relatively pure L-arabinose in pure form. Weibel-2 fails to teach a method of manufacturing L-arabinose via hydrolysis of pectin.

e. **Gatzi et al.**

Gatzi et al. teaches the catalytic hydrogenation of L-arabinose using Raney Ni and H_2 to produce L-arabitol. In contrast, the present invention couples hydrogenation of L-arabinose with the claimed method of manufacture of L-arabinose to create large quantities of L-arabitol. Gatzi et al. does not teach a similar method.

e. **Conclusion**

The references cited in the Office Action teach nothing that suggests combining them to create a method of manufacturing L-arabinose or L-arabitol. Weibel-1 and Weibel- 2 seek to prevent degradation of hemicellulose, while Schiweck degrades such polysaccharides to obtain L-arabinose. Therefore, there is no reason that one skilled in the art would be motivated to combine the teachings of Schiweck, Weibel-1, and Weibel-2. Further, Gatzi et

al. teaches a method of hydrogenating L-arabinose to create L-arabitol. Nothing in Gatzi et al. suggests combining with the other references to produce large quantities of L-arabinose and hydrogenating to produce L-arabitol.

The Office Action further asserts that one skilled in the art would have been motivated to combine the teachings of the above references in order to increase the yield and purity of L-arabinose due to a long felt need in the industry for such a process. It is true that there has been a long felt need in the industry. However, failure to remedy the long felt need speaks for non-obviousness. It is therefore impermissible hindsight to conclude that these references suggest combining.

The Applicant submits that by this amendment he has placed the case in condition for immediate allowance and such action is respectfully requested. However, if any issue remains unresolved, Applicant's attorney would welcome the opportunity for a telephone interview to expedite allowance and issue.

Respectfully submitted,

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